Table 2-1
GENERAL RESPONSE ACTIONS
FOR SURFACE & STOCKPILED MATERIAL [a]
With Initial Screening of Technologies and Process Options

General Response Action	Remedial Technology	Process Option	Description of Process Option	Technical Implementability/ Reason for Elimination
No Action	None	None	No action would be taken and operation of the existing water treatment plant (WTP) would cease. The contaminated area remains in its existing condition.	Required for consideration by NCP.
No Further Action	None	None	No new action would be taken, however the existing WTP would continue to operate without significant upgrades or repairs.	Retained for further consideration.
Institutional Controls	Land Use Controls	Deed/Zoning Restrictions	Permanent record of remaining COCs would be made and prevent or restrict residential use through legally binding requirements on property such as deed and zoning restrictions. Restrictions would be used to prevent use or transfer of property without notification of limitations on the use of the property.	Retained for further consideration.
	Access Restrictions	Physical Restrictions (Fencing and Posted Warnings)	The contaminated area would be enclosed by fences, berms, and warning signs to control access.	Retained for further consideration.
	Community Awareness	Information and Education Programs	Community information and educational programs would be undertaken to enhance awareness of potential hazards.	Retained for further consideration.
Monitoring	None	Long-term monitoring of COCs	Ongoing monitoring of COCs from different media types.	Retained for further consideration.
Containment	Covers	Regrading	Contaminated material would be regraded for slope stability and drainage.	Technically feasible and potentially applicable.
		Vegetative Cover	Establish native vegetation on existing surface soil capable of supporting vegetation. Where existing soil can not support vegetation a rooting medium would be placed.	Technically feasible and potentially applicable.

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General Response Action	Remedial Technology	Process Option	Description of Process Option	Technical Implementability/ Reason for Elimination
Containment (continued)	Covers (continued)	Compacted Soil/Clay Cover	Contaminated material would be covered with a layer of borrow soil/clay designed to reduce exposure and infiltration. Includes regrading and vegetative cover.	Technically feasible and potentially applicable.
		Multi-Layer Soil Cover	Contaminated material would be covered with an appropriate multi-layer soil cover designed to reduce exposure and infiltration. Includes regrading and vegetative cover.	Technically feasible and potentially applicable.
		Asphalt/Concrete Cover	Contaminated material would be covered with a single layer asphalt/concrete cap. The surface barrier would reduce infiltration through waste. Vegetation cover would not be possible.	Technically feasible and potentially applicable. However, longevity is suspect because of cracking from settlement and weather would reduce effectiveness. Not supportive of vegetation.
		Geosynthetic Clay (GCL) Cover	Contaminated material would be covered with appropriate GCL cover with a surface soil cover to support vegetation. The cap would be designed to reduce exposure and infiltration. Includes regrading and vegetative cover.	Technically feasible and potentially applicable.
		Flexible Membrane (FML) Cover	Contaminated material would be covered with an appropriate impermeable FML cover with a surface soil cover to support vegetation. The cap would be designed to reduce exposure and infiltration. Includes regrading and vegetative cover.	Technically feasible and potentially applicable.
	Barriers	Cryogenic Barrier	An array of freeze pipes are inserted around the contaminants and the contaminated material is frozen through connections to a refrigeration plant.	Not Retained. Would require a high level of operation and maintenance in perpetuity to be effective.
		Retaining Structures	Contaminated material would be physically stabilized by retaining structures.	Technically feasible and potentially applicable. Not applicable to backfilled pits.

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General Response Action	Remedial Technology	Process Option	Description of Process Option	Technical Implementability/ Reason for Elimination
Excavation, Transport, Disposal	Off-Site Disposal [b]	Existing Off-Site Landfill	Solids including sludge [b] would be disposed at an existing off-site landfill permitted to accept site waste such as Hanford or Envirosafe in Utah.	Technically feasible and potentially applicable.
		Existing Off-Site Disposal Site	Solids including sludge [b] would be disposed at an existing off-site disposal site permitted to accept site waste. This may include disposal at DMC site in Ford, WA or another site which currently being used for disposal of similar waste.	Technically feasible and potentially applicable.
	On-Site Disposal	On-Site Repository / Disposal Area	Solids would be disposed at a new on-site disposal cell.	Technically feasible and potentially applicable.
		On-Site Repository built to RCRA Subtitle C standards	Solids would be disposed at a new on-site repository that would be constructed to RCRA Subtitle C standards.	Technically feasible and potentially applicable.
		Disposal in Open Pits [c]	Solids would be relocated to disposal cells created within the existing open pits (Pit 3 and/or Pit 4). The open pit(s) could be lined and covered and may require removal of water [c].	Technically feasible and potentially applicable.
		Lining of Backfilled Pits	Temporary removal of waste rock/protore from backfilled pits, installation of liner system and drains then place back into pits.	Technically feasible and potentially applicable. Only applicable to backfilled pits.
		Segregation	Solids would be segregated based on COCs into stockpile(s) designed to reduce the area requiring a cover.	Technically feasible and potentially applicable.
		Consolidation	Solids would be consolidated within the MA, but outside the open pits, into a stockpile(s) designed to reduce the area requiring a cover.	Technically feasible and potentially applicable.

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General Response Action	Remedial Technology	Process Option	Description of Process Option	Technical Implementability/ Reason for Elimination
Treatment	Ex-Situ Physical/Chemical	Ex-situ Solidification/ Stabilization (S/S)	Contaminants are physically bound or enclosed within a stabilized mass in a process performed on site. In general, the process consists of injecting a chemical compound (stabilizing agent) to bind contaminants chemically to the soil matrix thereby reducing mobility. There are many distinct types of S/S processes.	Technically feasible and potentially applicable. Would require treatability testing.
		Neutralization	Solids would be chemically neutralized to reduce acid mine drainage (addition of lime, phosphate or other neutralizing agents) on site.	Technically feasible and potentially applicable.
		Flotation	Flotation separates metals or radionuclide-contaminated soil fractions from clean soil fractions in order to reduce the volume of soil requiring treatment or disposal. A chemical binds to the contaminated soil particle causing it to float where it can be skimmed off.	Not Retained. Soil particles at site may be too large for effective processing so pre-processing (crushing/grinding) may be necessary. Many different chemical solutions may be needed to treat the different COCs. In addition, COCs are not external to soil particle and may not be floated off.
		Soil Washing	COCs sorbed onto fine particles are separated from bulk soil in an aqueous based system on the basis of particle size. The wash water may be augmented with a reagent to help remove COCs.	Not Retained. Soil particles at site may be too large for effective processing so pre-processing (crushing/grinding) may be necessary. Many different washing solutions may be needed to treat the different COCs. In addition, COCs are not external to soil particle and may not be washed off.
		Solvent Extraction	A solvent would be applied to and extracted from the contaminated material. Contaminants would be transferred from excavated material to the solvent and then extracted from the solvent.	Not Retained. Not feasible for application to this site. Technology requires further development for radionuclides and mixed waste. In addition, COCs are not external to soil particle and may not be removed.

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General Response Action	Remedial Technology	Process Option	Description of Process Option	Technical Implementability/ Reason for Elimination
Treatment (continued)	In-situ Physical/ Chemical	In-Situ Soil Flushing	Washing solution (as with soil washing) is circulated through contaminated media via wells or trenches causing mobilization of sorbed COCs. The solution is then extracted and treated.	Not Retained. Not effective because a variety of flushing solutions may be needed to treat different COCs. In addition, COCs are not external to soil particle and may not be washed off.
		Deep Soil Mixing	Contaminated materials would be solidified/stabilized in-situ by a deep soil-mixing technique.	Not Retained. Technically not feasible for this site. Physical depth to mix would limit application.
		Electrokinetic Separation	In-situ waste material is electrically charged with direct current and electrodes, causing the transport/ removal of ions, particles, and water.	Not Retained. Not effective for radionuclides or large grained soils and has not been demonstrated to be effective with large material volumes.
		In-situ Stabilization/ Solidification	Materials containing COCs would be injected with a chemical compound to render the COCs insoluble or bind COCs chemically to the soil matrix.	Technically feasible and potentially applicable. Would require treatability testing.
	Thermal Treatment	Molten Glass Vitrification	Contaminated material is immobilized ex-situ by using heat generated from a bath of molten glass to incorporate inorganic constituents in a vitrified glass matrix.	Not Retained. Not feasible for application to this site because technology is not demonstrated for the large volume of material present.
		Plasma Arc Vitrification	Transfer of electric energy to plasma to waste which is broken down and pyrolyzed.	Not Retained. Not feasible for this site because technology is not demonstrated for the large volume of material present.
		In-Situ Vitrification	An electrical current is passed between electrodes inserted into contaminated media causes melting. Matrix is then allowed to cool into solid mass.	Not Retained. Not feasible for site application to this site. ISV is only effective treating near surface (15 feet) contamination.
		Incineration	Contaminated material is heated in a rotary kiln or fixed hearth to volatilize and combust the contaminants.	Not Retained. Not effective for metals and radionuclides.
		Thermal Desorption	Contaminated material is heated to approximately 600 to 1000 F to volatilize water and organic COCs.	Not Retained. Not effective for metals and radionuclides.

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General Response Action	Remedial Technology	Process Option	Description of Process Option	Technical Implementability/ Reason for Elimination
Treatment (continued)	Biological Treatment	Biodegradation	Naturally occurring or inoculated microbes are used to enhance degradation of COCs.	Not Retained. Not effective for metals and radionuclides.
		Bioventing	Oxygen, organic gas, or reducing gas is delivered to the soil by forced air movement to stimulate biodegradation of COCs.	Not Retained. Not effective for metals and radionuclides.
		Microbial Plugging with Ultramicrobacteria (Biobarrier)	This biotechnology introduces starved ultramicrobacteria (UMB) into permeable subsurface zones. Nutrients are then injected causing growth, which produces a plug in-situ. The resulting plug contains organic and inorganic contaminants.	Not Retained. This innovative technology is still in the developmental stage and has not been demonstrated in the field.
		Phytoremediation	Direct use of plants and their associated rhizospheric micro-organisms to remove, degrade, or contain chemical contaminants in soil and groundwater.	Technically feasible and potentially applicable. However, the technology is not effective beyond the depth of plant roots.
Processing	Resource Recovery	Off Site Milling/Physical Separation	Contaminated materials would be shipped and processed for minerals at an existing off site facility. Processed minerals may have resale value.	Technically feasible and potentially applicable.
		On Site Milling/Physical Separation	Contaminated materials would be processed for minerals at a new mill constructed at or near the site. Processed minerals may have resale value.	Technically feasible and potentially applicable.

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Denotes remedial technology process option that will not be carried forward for additional evaluation.

[a] Surface and Stockpiled materials includes backfilled or stockpiled ore, protore, waste rock, overburden, soil, and road materials
[b] Off-site disposal may also be applicable for residual/secondary wastes (sludge, filters, etc.) generated from water treatment process options presented on Table 2-4.
[c] Process options for water treatment are presented in Table 2-4 should it be necessary to remove water from the pits.

Notes: 1) Multiple response actions and remedial technologies will be combined to develop alternatives for surface & stockpiled material.

2) Process options retained for additional evaluation may not be applicable to all locations of the site or material types present at the site.

3) Based on the NCP, consolidation/containment remedial technologies are preferred for contaminated material with large volumes and low concentration levels. Smaller volumes of material with higher concentrations are more suited for treatment.

4) Remedial technologies requiring treatability testing could be performed during the remedial design phase.